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CHEMISTRY.—*A note on the precipitation of zirconium phosphate.* GEORGE STEIGER, Geological Survey.

The recent interest in the determination of zirconium seems to justify the publication of the results of some laboratory work done several years ago to determine the allowable acidity of a solution in which zirconium phosphate may be quantitatively precipitated. The work was done to determine more exactly the conditions necessary when applying this method to the analysis of rocks, which contain only small percentages of zirconium, and although the quantities involved were small the work showed that the composition of the phosphate ranges between limits so wide that unless conditions of precipitation are fully determined and rigorously maintained the results of such work can not be used in a gravimetric determination.

As the main object of this precipitation was the separation of zirconium from titanium, iron, and other metals in a rock, no effort was made to determine the conditions under which zirconium phosphate of constant composition may be precipitated.

In determining quantities of zirconium so small as those found in the average rock the analyst can obtain results that are sufficiently accurate by assuming that the composition of the ignited phosphate is ZrP_2O_7, and that it contains 46.32 per cent of ZrO_2. The results are given in the hope that they may be of service to those who are required to determine larger quantities of zirconium.

The standard zirconium solution used was made by preparing from native zircon the double fluoride of zirconium and potassium. After this salt had been purified by repeated crystallization it was decomposed with sulphuric acid and the fluorine was driven off by heat. Its strength was determined by precipitating the

TABLE I

PRECIPITATION OF ZrP_2O_7 IN PRESENCE OF SULPHURIC ACID

ZrO_2 taken	Bulk of solution	H_2SO_4 by weight	Amount of H_2O_2	When precipitate first showed	When precipitation seemed complete	ZrP_2O_7	Zirconium in filtrate from phosphate	ZrP_2O_7 fused with Na_2CO_3 leached with water: Residue: Ignited, fused with $NaHSO_4$, dissolved in water and precipitated with NH_4OH	Filtrate divided into two parts: Acidified with HNO_3 and determined P_2O_5	Filtrate divided into two parts: Acidified with HCl and tested for SO_3
1	2	3	4	5	6	7	8	9	10	11
grams	*cc.*	*per cent*	*cc.*			*grams*				
0.0182	100	1.0				0.0278	None		0.0144	None
0.0182	100	2.0				0.0293	None	0.0182	0.0122	None
0.0182	100	3.0				0.0337	None	0.0180	0.0184	None
0.0182	100	5.0				0.0353	Slight trace	0.0187	0.0170	None
0.0182	100	9.0				0.0357	0.0011	Lost	Lost	Lost
0.0101	100	0.1	5	Immediately	½ min.	0.0142	None	0.0095	Lost	
0.0101	100	0.1	5	Immediately	½ min.	0.0138	None	0.0101	0.0030	
0.0101	100	1.0	5	½ min.	5 min.	0.0157	None	0.0103	0.0053	
0.0101	100	5.0	5	2 min.	½ hr.	0.0156	0.0008	0.0105	0.0060	
0.0101	100	10.0	5	Had not appeared in ½ hr.	Over night	0.0185	0.0024	0.0099	0.0095	

zirconium with ammonia, filtering and igniting the precipitate, and weighing the residue as oxide. The volume of the solution finally used in each experiment was 100 cc., and to conform with conditions met in practice, it was made up in part of hydrogen peroxide. The sulphuric acid was added to the solution in varying quantities, and the zirconium precipitated by the addition of microcosmic salt. The solutions were constantly stirred while

the salt was added and allowed to stand over night before filtering. The precipitates obtained were weighed, fused with sodium carbonate, leached with water, and filtered. To determine zirconium the insoluble residue was fused with sodium bisulphate, and the melt was dissolved in water, precipitated with ammonia, filtered, and the zirconium weighed as oxide. The phosphorus in the leach water was determined as $Mg_2P_2O_7$ after preliminary precipitation as phospho-ammonium molybdate. Repeated tests of the leach water for sulphates showed that the precipitation of the phosphate did not carry down sulphate.

As both iron and titanium may be thrown down with zirconium phosphate it is desirable to use a solution containing the greatest possible quantity of free acid, and the titanium must be kept well oxidized with hydrogen peroxide in order to prevent it from being precipitated.

Other phosphates than zirconium phosphate, except those of the rare earth metals, are readily soluble and may be easily separated in dilute acid solutions.

It is not safe to base definite conclusion on the results of work involving quantities so small as those used in these experiments, but those results indicate the formation of a basic salt that approaches normal zirconium phosphate as the acidity of the solution is increased. The table given indicates that the solution employed may safely contain at least 3 per cent and perhaps as much as 5 per cent of free sulphuric acid.

BOTANY.—*The North American species of Genipa.*[1] PAUL C. STANDLEY, National Museum.

The genus *Genipa* is a member of the family Rubiaceae, tribe Gardenieae, being closely related to the genera *Gardenia* and *Randia*. About 15 species are known, most of them American (chiefly South American), although several have been described from the tropics of the Old World. From North America 3 species of the genus have been reported heretofore, *Genipa americana* L., *G. caruto* H. B. K., and *G. codonocalyx* Standl. *Genipa*

[1] Published with the permission of the Secretary of the Smithsonian Institution.

americana L.[2] was based upon Plumier's description and illustration of a West Indian plant. It has several synonyms, but only one of importance. In 1818 Kunth described[3] *G. caruto*, from material obtained by Humboldt and Bonpland in Colombia and Venezuela. *Genipa caruto* has been recognized rather generally as a valid species, but it differs from the earlier *G. americana* only in having copious pubescence, the latter plant being nearly or quite glabrous. In the absence of any concomitant characters the presence or absence of pubescence is scarcely a sufficient basis for specific segregation; consequently it seems preferable to consider *Genipa caruto* a synonym or at most a subspecies of *G. americana*.[4]

This is one of the best known and most interesting plants of the American tropics. It ranges from southwestern Mexico (Guerrero to Chiapas) through Central America to Peru and Brazil, and occurs also in Cuba, Hispaniola, Porto Rico, and the Lesser Antilles. It is a tree sometimes 20 meters high, with a trunk up to 50 cm. in diameter, with stout, spreading branches. The large, entire leaves are usually obovate, and 14 to 35 cm. long, with a breadth of 6 to 19 cm. The sweet-scented flowers are borne in small dense cymes, the corollas being salverform, white or yellowish white, and 2 to 4.5 cm. long. The fruit is subglobose, 6 to 7 cm. in diameter, or often larger, 2-celled, covered with a thick, smooth or rough, russet or brownish green rind. The large, flat, brown seeds are imbedded in a scant, whitish, acidulous pulp with violet juice.

Through its wide area of distribution many different names are applied to the plant, some of which are the following: "Caruto" (Venezuela, Colombia), "jagua" (Venezuela, Colombia, Porto Rico, Panama, Nicaragua, Mexico), "jagua azul" (Tabasco), "jagua blanca" (Tabasco), "guaitil" (Costa Rica), "tapaculo" (Nicaragua,) "yigualtí" (Nicaragua), "gigualtí" (Nicaragua).

[2] Syst. Veg. ed. 10. 931. 1759.

[3] H. B. K. Nov. Gen. & Sp. 3: 407. 1818.

[4] Schumann (in Mart. Fl. Bras. 6[6]: 352. 1889) has treated *G. caruto* as a subspecies of *G. americana*, under the name *G. americana caruto*. The form is of sufficient importance, probably, to receive nomenclatural recognition. The pubescent plant occurs in continental North America, while the glabrous form is found in the West Indies.

The wood of this tree is soft and fibrous but strong, elastic, and resistant, with a specific gravity reported to range from 0.670 to 0.873. In color it is whitish tinged with reddish gray, or sometimes gray, and is said to take a good polish and to resist the attacks of insects. It has been used in making gunstocks, axe handles, wagons, and other articles. The bark is astringent and is sometimes used for tanning. A decoction of the roots is said to be used for venereal diseases in the West Indies. In Brazil the leaves are reported to be valuable as forage for cattle, and the fruits are said to fatten pigs.

The fruit of *Genipa americana* is doubtless the most important and widely used part of the plant. It is used in Porto Rico and elsewhere to prepare a refreshing beverage, and it is also often fermented to produce an intoxicating drink. When green or ripe it contains copious juice which imparts to everything with which it comes in contact a blue, violet, or nearly black stain. Among the native tribes of tropical America the juice has been highly esteemed for dyeing cloth and other articles. More important, however, is its wide employment among the aborigines for painting and tattooing the skin. For this purpose it is still much used by the uncivilized tribes of certain parts of South America. It is said that the Indians paint their skins with it not only for adornment, but to protect themselves partially against the attacks of the insects so annoying to human life in humid tropical regions.

Because of the economic importance of the commonest species of the genus, it is of interest to find in the U. S. National Herbarium specimens of two rubiaceous plants of Panama, evidently undescribed, which apparently are congeneric. Diagnoses of these are given below. Although both are known only from fruiting material, and it may be that the flowers, when collected, will show that they are not properly referable to *Genipa*, they are certainly closely allied, and agree better with *Genipa* than with any other genus of American Gardenieae.

Besides *Genipa americana*, the other published North American species of the genus is *G. codonocalyx*, described[5] recently by the writer from the Pacific coastal belt of Cost Rica. This is known

[5] Contr. U. S. Nat. Herb. 17: 446. 1914.

only from a single collection, and may be merely a variant of the common species.

Genipa maxonii Standl., sp. nov.

Large spreading tree, the wood pinkish, the branchlets glabrous, with short internodes; stipules lance-oblong, about 3.5 cm. long, filiform-attenuate, glabrous; petioles about 2 mm. long; leaf blades obovate or rhombic-obovate, 34–44 cm. long, 13.5–25 cm. wide, narrowed from below the middle to a rounded or subtruncate base, narrowed to the apex and subabruptly obtuse-acuminate, chartaceous, bright green above, reddish along the veins, sublustrous, glabrous, the costa and lateral veins impressed, paler and reddish beneath, obscurely puberulent when young, the venation prominent, the lateral veins slender, about 20 on each side, nearly straight, the secondary veins numerous, parallel, distinct, the ultimate veinlets prominulous, reticulate, the margin plane; fruit (probably immature) globose, 5.5 cm. in diameter, glabrous, the pericarp about 4 mm. thick; seeds irregularly rhombic, 1.5–2.5 cm. long, very thin, black, lustrous, the corklike flesh breaking up into large flat irregular sections, each containing a single seed.

Type in the U. S. National Herbarium, no. 675223, collected in forest along the Río Indio de Gatún, Canal Zone, Panama, near sea-level, February 17, 1911, by William R. Maxon (no. 4848).

The venation of the leaves is very different from that of *G. americana*, and the leaves are narrowed to an obtuse base, rather than to a very acute base, as in that species. The corklike flesh which envelops the seeds appears quite unlike the flesh of young fruits of *G. americana*.

The wood of *Genipa maxonii* has a beautiful pinkish tint. Mr. H. Pittier forwarded from Panama a small box made of wood which appears to belong to this tree, although it may have come from some allied rubiaceous species. This wood is rather fine-grained, and probably would take a handsome polish. It agrees in its pink coloration with the branches of the type specimen of *Genipa maxonii*. When exposed for some time to sunlight the wood loses its original color and assumes a dirty-white appearance, but after being kept in a dark place the former coloration is finally restored.

Genipa williamsii Standl., sp. nov.

Tree, 10 meters high, the trunk 12.5 cm. in diameter, the branchlets reddish brown, glabrous, the internodes short; stipules broadly obovate, 1.8 cm. long, 1.2 cm. wide, cuneate at the base, rounded at the apex, brownish, sparsely strigose outside; petioles stout, 1–2.5 cm. long, glabrate; leaf blades obovate or oblong-obovate, 12.5–19 cm. long, 6–9.5 cm. wide, acute or cuneate at the base, rounded at the apex, chartaceous, green above, sublustrous, glabrous, the venation plane or prominulous, brownish beneath, strigose along the veins, the costa stout,

prominent, the lateral veins slender, 8 or 9 on each side, ascending at a wide angle, nearly straight, laxly anastomosed near the margin; fruit subglobose, 4.5 cm. in diameter, terminal, solitary, subsessile, the pericarp very thick; seeds (very immature) numerous.

Type in the U. S. National Herbarium, no. 678301, collected in the vicinity of Cana, Panama, altitude 1350 meters, in 1908, by R. S. Williams (no. 814).

A relative of *Genipa americana*, apparently, but very different in the rounded apex of the leaves and rounded, obovate stipules.

ZOOLOGY.—*Classification of the Philippine operculate land shells of the family Helicinidae, with a synopsis of the species and subspecies of the genus Geophorus.*[1] PAUL BARTSCH, National Museum.

The constant demand for determinations of Philippine land shells frequently makes it necessary to lay aside monographic work on the mollusks of these islands, in order to straighten out the nomenclature of a group wholly different from the one upon which the writer may be engaged. This is true in the present instance. Several sendings of *Helicina*, in the old sense of that term, have made it necessary to subject the whole group, which is a rather large one, to critical examination. It is believed that the synopsis of the superspecific groups and the keys and brief comments on the species and subspecies of the largest genus of the family in the islands, *Geophorus*, will prove helpful in classifying material.

The genus *Geophorus* is not a difficult one. The greatest trouble in the past appears to have been the assigning of too many forms to one name, for frequently in the past authors have assigned to one species specimens which we now know belong to different genera. A very careful inventory of all the characters should enable anyone readily to place any of the known forms under its proper name by the use of the appended keys and critical remarks.

In the preparation of this paper, I have been particularly fortunate in having in the National Museum collections a set of Sowerby's cotypes collected in the Philippine Islands by Hugh Cuming, and also a set of von Möllendorff's Philippine Island shells,

[1] Published by permission of the Secretary of the Smithsonian Institution.

which helped materially in the fixing of the majority of the old names.

The members of the family *Helicinidae* found in the Philippine Islands belong to the subfamily *Helicininae*, which in turn breaks up into five genera; namely, *Ceratopoma*, *Pleuropoma*, *Sulfurina*, *Geophorus*, and *Kosmetopoma*.

All of these genera are based upon opercular characters which appear wonderfully constant.

Of these genera, *Ceratopoma* Möllendorff has the least specialized operculum, for here we find a simple thin transparent horny shield without calcareous deposit. The type of this genus is *Helicina caroli* Kobelt.

In *Pleuropoma* Möllendorff the operculum is still simple, i.e., a horny shield, but there is in addition a slight deposition of calcareous material. A flexuose ridge extends close to the margin in a sigmoid curve from the columellar border along the parietal edge. This gives the edge of this portion and in some species the entire operculum the appearance of being double. The type of this genus is *Helicina dichroa* Möllendorff.

In *Sulfurina* Möllendorff we find the operculum similar to that of Pleuropoma but the calcification is stronger and the flexuose line is replaced by a strong raised keel which is usually a little farther removed from the edge. The type of this genus is *Helicina citrina* Sowerby.

In typical *Geophorus* the operculum is much thickened by calcareous deposits. The columellar border bears a deep groove, giving this portion the appearance of being double.

This groove frequently extends for a considerable distance along the two long sides. The outer portion at the columellar border is frequently a little shorter than the inner, and at times considerably thickened, particularly at the posterior columellar angle, where even a knob develops in some forms. The above characters apply to *Geophorus* in the restricted sense as typified by *Helicina agglutinans* Sowerby, the genotype. There are, however, two modifications of this form of operculum, one in which the columellar border is thickened into a strong knob at the parietal edge on the outside, which is limited anteriorly by a slit or deeply

impressed groove. Upon this group I will bestow the subgeneric name *Schistopinax* with *Geophorus* (*Schistopinax*) *siquijorensis* Bartsch as genotype.

The other group has the main portion of the operculum, as in typical *Geophorus*, but a strong lamella extends across the operculum on the outside a little distance from the columellar border dividing this into a large shallow spoon shaped area, and a deep pit between the columellar border and the lamella. The group of mollusks having these opercular characters are now assigned to a new subgenus, *Diplopinax*, with *Geophorus* (*Diplopinax*) *peracutissimus* Wagner as genotype.

Geophorus therefore breaks up into the three subgenera, *Geophorus*, *Schistopinax*, and *Diplopinax*.

The most highly specialized operculum is possessed by the genus *Kosmetopoma* Wagner, which has the inside not unlike *Sulfurina*, with the internal ridge quite low, while the exterior is marked on the edge adjoining the outer and basal lip by several dentate ridges. The type of this genus is *Helicina amaliae* Kobelt.

The mollusks of this genus are earth dwellers; i.e., they live on the ground among the dead leaves about the base of trees and rocks, but their favored place of abode is found in the pockets, nooks, and crannies of honey-combed limestone in shady moist situations. I have, on several occasions, picked thousands from an area of a few square yards under such circumstances. During the rainy season they become quite active and one may then find them crawling up the lower portions of the bowl of trees and on fallen logs or rocks, while during the dry period they are neatly wedged away in the crevices of the rock and between chinks of bark and the leaf or moss-covered base of trees.

Key to the sections of the subgenus Geophorus

Spiral sculpture present.
  Angle at junction of columella and basal lip present.....I
  Angle at junction of columella and basal lip absent.....II
Spiral sculpture absent.
  Angle at junction of columella and basal lip present.....III
  Angle at junction of columella and basal lip absent.....IV

In the use of this key care must be taken not to confuse the fine cross-hatch or crinkly short lines, which are found in varying strength in all the members of the genus, with true incised spiral lines. The junction of the columella and the basal lip in one big series always forms a conspicuous angle. Members of this group practically always have the columella decidedly excavated. In the other series, the columella passes directly into the basal lip with scarcely an indication of the junction.

Section I

In this section, fine incised spiral lines are present. The columella is strongly excavated and forms a conspicuous angle at its junction with the basal lip. The following key will help in the identification of the known forms:

Greater diameter more than 14 mm.
  Periphery with an obsolete keel.....*boholensis* Bartsch
  Periphery with a strongly compressed keel
    Base decidedly inflated.....*pachychilus* Möllendorff
    Base not inflated
      Greater diameter more than 16 mm.....*romblonensis* Bartsch
      Greater diameter less than 15 mm.....*mindoroensis* Wagner
Greater diameter less than 12 mm.
  Spire rather elevated.....*negrosensis* Bartsch
  Spire rather depressed
    Shell yellow.....*nitidulus* Möllendorff
    Shell japan rose.....*versicolor* Möllendorff

The specimens of this section fall readily into two groups, one embracing large shells, in which the diameter is always more than 14 mm., and one in which the diameter is always less than 12 mm. There are four species of the larger forms. Of these, the specimens from Bohol, *Geophorus boholensis* n. sp., have the peripheral keel obsolete and the base decidedly inflated. No depression is present at the junction of the base and the peripheral keel. This is the largest of the four species. The type, Cat. No. 104419, U. S. National Museum, has 5.1 whorls and measures: altitude, 10 mm.; greater diameter, 16.5 mm.

The other three species have the peripheral keel very strongly developed. One of these, *Geophorus pachychilus* Möllendorff has the base strongly inflated and but slightly concaved at its junction with the peripheral keel. This species comes from the island of Guimaras. A typical specimen of this species, Cat. No. 258761, has 5.3 whorls and measures: altitude, 16.3 mm.; greater diameter, 14.7 mm.

The other two species have the base only moderately convex. The one *Geophorus romblonensis* n. sp., coming from the island of Romblon, is a rather compressed form, having a very broad peripheral keel, with a decided depression at the junction of the base and keel. The type of this, Cat. No. 334254, has 5.5 whorls, and measures: altitude, 8 mm.; greater diameter, 16.5 mm.

The fourth species, *Geophorus mindorocnsis* Wagner which is also rather depressed, is much smaller than the last and comes from the island of Mindoro. A typical specimen, Cat. No. 184940, having 5.1 whorls, measures: altitude, 7.1 mm.; greater diameter, 14.3 mm.

Of the smaller species belonging to this section, three are known. One of these from the island of Negros, which may be known as *Geophorus negrosensis* n. sp., has the spire rather elevated. The type of this, Cat. No. 302751, has 5.5 whorls and measures: altitude, 7.3 mm.; greater diameter, 10.9 mm.

The other two species have the spire rather depressed. On one of these, *Geophorus nitidulus* (Möllendorff) Wagner, the shell varies from yellow to born colored. This comes from central Luzon, and is particularly abundant in the region of Montalban. A typical specimen, Cat. No. 256989, having 5.3 whorls, measures: altitude, 6 mm.; greater diameter, 10.6 mm.

The last species, *Geophorus versicolor* Möllendorff, which comes from the island of Sibuyan, has the whorls japan-rose colored. A specimen of this species, Cat. No. 195495A, having 5.6 whorls, measures: altitude, 6.8 mm.; greater diameter, 11.9 mm.

Section II

The second section has fine incised spiral lines, but the columella is not strongly excavated, nor does its junction with the basal lip form a decided angle, but the columella passes almost without demarcation into the basal lip. Of this section there are five species.

Shell with a brown band on the base near the periphery.
Greater diameter more than 15 mm.....*worcesteri* Bartsch
Greater diameter less than 10 mm.....*benquetanus* Bartsch
Shell without a brown band on the base near the periphery.
Greater diameter more than 14 mm.....*catainganus* Bartsch
Greater diameter less than 8 mm.
Shell decidedly elevated.....*trochulus* Möllendorff
Shell depressed.....*monticolus* Möllendorff

Two of the five forms of this section have a brown band near the periphery on the base. One of these, *Geophorus worcesteri* n. sp., which

comes from the island of Leyte, is a large form. The type, Cat. No. 184931, has 5.1 whorls and measures: altitude, 8.4 mm.; greater diameter, 15.2 mm.

The other banded form, *Geophorus benguetanus*, n. sp., is globose and decidedly smaller. It comes from the mountains of the Benguet region, Luzon. The type, Cat. No. 239871, has 4.5 whorls and measures: altitude, 6.1 mm.; greater diameter, 9.4 mm.

Of the five unbanded forms, the largest, *Geophorus catainganus* n. sp., comes from Cataingan Bay on the island of Masbate. This is well elevated and has the base quite convex and a strong depression at the junction of the base and the peripheral keel. The type, Cat. No. 258768, has 5.1 whorls and measures: altitude, 9.5 mm.; greater diameter, 14.2 mm.

The two remaining forms are small species. Of these, one, *Geophorus trochulus* Möllendorff, which comes from the island of Tablas, is decidedly elevated. A specimen of this, Cat. No. 195507, has 5.1 whorls and measures: altitude, 6.2 mm.; greater diameter, 7.4 mm.

The other species, *Geophorus monticolus* Möllendorff, is rather depressed. A specimen, Cat. No. 184927, from Morong, Luzon, has 4.8 whorls and measures: altitude, 4.5 mm.; greater diameter, 6.4 mm

Section III

This group of *Geophorus* has no spirally incised lines. The columella is excavated and forms a decided angle at its junction with the basal lip. The shells thus characterized fall readily into three groups.

Shell large, broadly conic.
Shell with color bands.....Group A
Shell without color bands.....Group B
Shell small, narrowly conic.....Group C

Group A

Shell large, broadly conic, marked by color bands

Shell decidedly elevated.
The summit of the last whorl falling below the strong peripheral keel and permitting this to show as a frill at the suture.....*peracutus* Wagner
The summit of the last whorl not falling below the strong peripheral keel but appressed to it.
Greater diameter of shell more than 12 mm.....*leytensis* Bartsch
Greater diameter of shell less than 12 mm.....*leytensis basiaoensis* Bartsch
Shell rather depressed.
Greater diameter more than 13 mm.....*siargaoensis* Bartsch
Greater diameter less than 11 mm...*siargaoensis surigaoanus* Bartsch

There are three species and two subspecies of red and yellow-banded *Geophorus* which have a granular upper surface, no incised spiral lines, and an excavated columella that forms a decided angle at its function with the basal lip. One of these, *Geophorus paracutus* Wagner, from the island of Tablas, is a stout conic form, having the whorls but slightly convex and possessing a strong peripheral keel below which the summit of the last two turns falls in such a manner as to leave this in the suture as a frill. The early whorls of this species are yellow while the last has a zone of yellow at the summit and another at the periphery, the rest of the surface being red. The lower surface beyond the peripheral keel, which is of the same color as above, is brown, turning paler at the umbilical callus, which is pale yellow. The inside is brown while the peristome is white, washed on the inner border with brown. A specimen of six whorls measures: altitude, 8.8 mm.; greater diameter, 14.1 mm.

The banded shells from Jaro, Leyte, *Geophorus leytensis* n. sp. have the whorls more rounded than those on Tablas and the summit of the last whorl does not fall below the peripheral keel, but is appressed to its edge. The main color of the upper surface is dark red on the later whorls, edged with a narrow zone of bright yellow at the summit and the periphery. The lower surface has a yellow peripneral zone followed by a broad band of red, while the median half is pale yellow. The interior corresponds with the external color pattern. The type, Cat. No. 219023, has 5.5 whorls and measures: altitude, 8.3 mm.; greater diameter, 13 mm.

Specimens from Basiao Island, off Samar, closely resemble *Geophorus leytensis* in outline and coloring but the yellow bands are a lttle broader and the shell is much smaller. These may be known as *Geophorus leytensis basiaoensis* n. subsp. The type of this subspecies has 5.5 whorls and measures: altitude, 7.5 mm.; greater diameter, 11 mm.

The third species is the most brilliantly colored and beautiful of all the known Philippine Island Helicinids. The shell is very broadly conic and but moderately elevated, the extreme apex extending scarcely more above the periphery than the anterior tip of the columella extends below it. The early whorls are bright yellow. The last has a broad yellow band on the summit, which is about two-thirds as wide as the dark brown band that follows, which in turn equals the bright yellow zone that bounds the very strongly angulated periphery. The brown band pales as it passes backward from the aperture which, by the way, it does not quite reach, for it terminates abruptly a little behind it and

is quite lost on the second turn back. The base is bright pale yellow excepting a sharply limited brown zone which is about as broad as the yellow zone that intervenes between this and the periphery. The interior corresponds with the exterior in coloration, the peristome being bright pale yellow. This species, which comes from the island of Siargao, may be known as *Geophorus siargaoensis* n. sp. The type, Cat. No. 184,929 has 5 whorls and measures; altitude, 7 mm.; greater diameter, 13.2 mm.

In the northeast portion of Mindanao, at Surigao, a small race of this species occurs, which differs from *Geophorus siargaoensis* chiefly in its lesser size, but also in having the basal brown band a little nearer the periphery and not so sharply limited. This smaller race may be known as *Geophorus siargaoensis surigaoanus* n. subsp. The type, Cat. No. 302772, has 5.1 whorls and measures: altitude, 6.3 mm.; greater diameter, 10.8 mm.

Group B

Shell large, broadly conic, without color bands

Peripheral keel compressed.
Operculum broadly oval.....*ticaoensis* Bartsch
Operculum rhomboidal.
Peripheral keel limited on the under side by a strongly incised line.
Middle whorls mustard yellow.
All whorls mustard yellow.....*tantalus tantalus* Bartsch
All whorls not mustard yellow, the last turns with a paler zone at the summit.....*tantalus masbatensis* Bartsch
Middle whorls capucine orange.
Last whorl pale capucine orange.*tantalus palawanensis* Bartsch
Last whorl flesh colored.....*tantalus mansalayanus* Bartsch
Peripheral keel not limited by an incised line on the under side.....*romblonensis* Bartsch
Peripheral keel rounded.....*agglutinans* Sowerby

Sowerby, in describing *Helicina agglutinans*, listed three varieties. Of these, variety *a* comes from the island of Guimaras, variety *b* from Bohol, and variety *c* from Panay. The name *agglutinans* Sowerby has since been fixed upon variety *c* by Wagner. This is a large shell which has a rounded peripheral keel, with the base somewhat inflated. There is no depressed area between the periphery and the rest of the base. The upper surface of the shell is uniformly bright yellow while the lower has a narrow zone of yellow near the periphery, below which it is suffused with reddish brown, this color shading gradually to yellow on the middle

of the base. A cotype collected by Cuming, Cat. No. 302753, has 5 whorls and measures: altitude, 9.2 mm., greater diameter, 17.3 mm.

The shells from the island of Ticao belonging to this section have the base decidedly inflated and the aperture very high, which gives the operculum an oval, rather than a trapezoidal appearance. The shells are large, barium yellow, paling toward the aperture. The upper surface is marked by coarse irregular lines of growth, the suture being rendered irregular and wavy by the coarse sculpture. The peripheral keel is reduced to a cord, which is limited by a shallow depression on the under side only. These shells may be known as *Geophorus ticaoensis* n. sp. The type, Cat. No. 256999, comes from San Miguel, Ticao. It has 5 whorls and measures: altitude, 8.9 mm.; greater diameter, 14.8 mm.

The most difficult group of this section is represented in our collection by a series of specimens from the islands of Mindoro, Palawan, Samar, and Masbate. This group embraces medium-sized shells having a moderately elevated spire and a narrow peripheral keel, which is bounded on the lower side by a well incised spiral line. They represent a distinct group to which the name *Geophorus tantalus* n. sp. may be applied. I have seen good series of specimens from the four above mentioned islands which demand a further subdivision of this species, as indicated in the key. The specimens from Samar have the shell mustard yellow and this race may carry the subspecific name *Geophorus tantalus tantalus* Bartsch. The type, Cat. No. 288773, comes from near Catbalogan, has 5 whorls, and measures: altitude, 7.1 mm.; greater diameter, 10.7 mm.

The specimens from Masbate are of similar coloration as the last excepting that on the last two turns a lighter yellow zone bounds the summit. This race may be known as *Geophorus tantalus masbatensis* n. subsp. The type of this, Cat. No. 258769, comes from Cataingan Bay and has 5.5 whorls, and measures: altitude, 6 mm.; greater diameter, 10.2 mm.

The western specimens, i.e., those from the islands of Mindoro and Palawan, have the extreme tip mustard yellow and the turns immediately succeeding capucine orange. In the specimens from Palawan the last turn is pale capucine orange. This species may bear the name *Geophorus tantalus palawanensis* n. sp. The type of this, Cat. No. 334256, comes from Bacuit, has 5.1 whorls and measures: altitude, 6.3 mm.; greater diameter, 10.6 mm.

The shells from Mindoro agree with the last excepting that the last turn is flesh colored. These may bear the trinomial designation *Geo-*

phorus tantalus mansalayanus n. subsp. The type, Cat. No. 258762, comes from Mansalay Bay, has 5.6 whorls, and measures: altitude, 6.4 mm.; greater diameter, 10.8 mm.

From the island of Romblon we have seen several lots of shells which agree with *Geophorus tantalus* Bartsch in size and general sculpture, but the peripheral keel is wider and not limited on the basal side by an incised line. A shallow depressed concave area separates the convex portion of the base from the peripheral keel. This form also has the whorls considerably more convex on the upper side than the shells of *Geophorus tantalus* and the sculpture is very coarse, while in Geophorus *tantalus* it is rather fine. I therefore feel that it is specifically distinct from *Geophorus tantalus* and it may be known as *Geophorus romblonensis* n. sp. The type, Cat. No. 208246, has 5.3 whorls and measures: altitude, 7 mm.; greater diameter, 11.5 mm.

Group C

Shell small, narrowly conic

Shell with a deep umbilical pit..... *pseudomphalus* Möllendorff
Shell without a deep umbilical pit.
  Shell with a strongly compressed peripheral keel
    cyrtopomus Möllendorff
  Shell with a rounded peripheral cord.
    Peripheral cord strong, coarse and wavy
      trochaceus calayanensis Bartsch
    Peripheral cord well rounded, smooth.
      Upper surface coarsely granular.
        Greater diameter 8.9 mm..... *trochaceus palauiensis* Bartsch
        Greater diameter 7.9 mm..... *trochaceus marivelesanus* Bartsch
      Upper surface finely granular.
        Shell elongate conic..... *trochaceus trochaceus* Möllendorff
        Shell broadly conic.... *trochaceus nanus* (Möllendorff) Wagner

The small conic granulose *Geophorus* having an excavated columella that forms a strong angle at its junction with the basal lip and lacking spirally incised lines, fall readily into three divisions, which may be considered species. One of these, *Geophorus pseudomphalus* Möllendorff, has a strongly impressed umbilical pit. This is so far known only from the environs of Sibul, Bulacan Province, Luzon. The second species, *Geophorus cyrtopomus* Möllendorff, ranges through the mountains of central Luzon at least from Montalban to Morong. It is characterized by a decidedly compressed peripheral keel and decidedly less elevated spire than the next species. The third species, *Geophorus trochaceus* Möllendorff, has a much wider range in distribution and

breaks up into a number of geographic races. *Geophorus trochaceus trochaceus* Möllendorff comes from the island of Leyte. It is a very small shell of elongate conic form, having the peripheral keel rather rounded and the upper surface finely granulate. A specimen of *Geophorus trochaceus trochaceus* Möllendorff from Leyte, Cat. No. 302767, has 5.3 whorls and measures: altitude, 5.3 mm.; greater diameter, 6.8 mm. The most northern race, *Geophorus trochaceus calayanensis* n. subsp., comes from Calayan Island, of the Babuyanes group. This is considerably larger than the typical form with coarser incremental lines and granulations. The peripheral keel, too, is stronger, irregular and wavy. The type of this, Cat. No. 334254, has 5.3 whorls and measures: altitude, 6.2 mm.; greater diameter, 8.1 mm.

Another, *Geophorus trochaceus palauiensis* n. subsp., recalls strongly the shell from Calayan. It is almost of the same size but has the peripheral keel well rounded and is in every way less coarsely sculptured than the northern representative. It comes from Palaui Island. The type, Cat. No. 258789 has 5.3 whorls and measures: altitude, 6.2 mm.; greater diameter, 8.9 mm.

Two additional subspecies occur upon the island of Luzon. One, a medium sized form, *Geophorus trochaceus marivelesanus* n. subsp., which is known from the southern end of the Zambales range at Mariveles. This, like the Palaui race, has the upper surface coarsely granular, but it is much smaller. The type, Cat. No. 302774, has 5.3 whorls and measures: altitude, 5.3 mm.; greater diameter, 7.8 mm.

The smallest race, *Geophorus trochaceus nanus* (Möllendorff) Wagner, comes from Sibul, Bulacan Province. This race has a lesser number of whorls and is a little more finely granular than the other Luzon forms. A typical specimen, Cat. No. 195491, having 4.5 whorls measures: altitude, 4 mm.; greater diameter, 5.8 mm.

Section IV

Shell banded..... *acutissimus* Sowerby
Shell not banded.
  Shell broadly conic..... *palananus* Bartsch
  Shell narrowly conic.
    Operculum with a knob at the posterior columellar border *perezi* Bartsch
    Operculum without a knob at the posterior columellar border *caramoanus* Bartsch

The section in which the spiral sculpture is absent and in which the columella is not excavated and in which there is no decided angle at

the junction of the columella and basal lip is rather small. It is represented at present by four forms only, coming from the islands of Luzon, Pagbilao, and Bohol. One of these three forms has color bands. The largest, *Geophorus acutissimus* Sowerby, comes from the island of Bohol. In this, all but the last turn are pale yellow, the last is flesh-colored. There is a zone of rose pink at the summit and an equal one near the peripheral keel. A third cone about twice as wide as these is on the base separated from the peripheral keel by a narrow light zone. On the inside of the aperture these red bands are almost scarlet. A cotype, of this species, Cat. No. 104415, collected by Cuming, has 5 whorls and measures: altitude, 9 mm., greater diameter, 16.7 mm.

Of the three unbanded forms of this section one, *Geophorus palananus* n. subsp., is of medium size, broadly conic, and of quite uniform honey, yellow. The sculpture of the upper surface is much coarser than in the preceding. This race comes from Palanan, Isabela Province, Luzon. The type, Cat. No. 302787, has 5 whorls and measures: altitude, 6.3 mm.; greater diameter, 9.9 mm.

Two of the races have a decidedly elevated narrow conic shell. One of these, *Geophorus perezi*, n. sp., comes from the greater Pabgilao Island, off southwestern Luzon. This is a small form in which the operculum is very broad and bears a decided knob at the posterior columellar border. The type, Cat. No. 310058, has 5 whorls and measures: altitude, 5.2 mm.; diameter, 7.6 mm. The other, *Geophorus caramoanus* n. sp., comes from Caramoan on the south end of the Caramoan peninsula in Ambos Camarines, Luzon. This has the shell a little more elevated than *G. perezi* Bartsch, with the operculum much narrower and with a tooth on the posterior columellar end of it. The type, Cat. No. 195504, has 5 whorls and measures: altitude 5 mm.; greater diameter, 6.8 mm.

Schistopinax, new subgenus

In this subgenus, the columellar border is thickened into a strong knob at the parietal edge on the outside, which is limited anteriorly by a deeply incised groove.

Greater diameter more than 12 mm..... *siquijorensis* Bartsch
Greater diameter less than 8 mm.
Last whorl moderately rounded..... *trochiformis* Sowerby
Last whorl very strongly rounded
trochiformis subtrochiformis (Möllendorff) Wagner

Of this subgenus I know only three forms and of these only one from personal examination; namely, the type of the subgenus, *Geophorus*

(*Schistopinax*) *siquijorensis* n. sp. This species, which comes from the island of Siquijor, is broadly conic and has a brown band on the base near the periphery. The type, Cat. No. 195499, has 5.5 whorls and measures: altitude, 7.5 mm.; greater diameter, 12.8 mm.

The other two forms are much smaller and narrowly conic. *Geophorus* (*Schistopinax*) *trochiformis* Sowerby comes from the island of Negros. Wagner cites 4.5 whorls with an altitude of 5.5 mm. and a major diameter of 6.5 mm. for the specimen he figures. He states and shows that this is a little less elevated and has the last whorl a little less rounded than *Geophorus* (*Schistopinax*) *trochiformis subtrochiformis* (Möllendorff) Wagner, which he describes from the island of Marinduque, and for which he gives the measurements: altitude, 5.5 mm.; greater diameter, 7 mm.

Diplopinax, new subgenus

This subgenus is characterized by having the outer surface of the operculum crossed by a lamella which divides the operculum into a shallow, large labial portion and a strong pit at the columellar end. Type: *Geophorus* (*Diplopinax*) *tagbilleranus* Bartsch.

Incised spiral lines present.
  Color band present on the base.
    Greater diameter more than 13 mm. . . . . *acutus* Pfeiffer
    Greater diameter less than 11 mm.
      albocarinatus (Möllendorff) Wagner
  Color bands absent on the base.
    Greater diameter more than 17 mm. . . . . *bothropomus* Möllendorff
    Greater diameter less than 12 mm.
      Spire decidedly elevated. . . . . *conoidalis* Möllendorff
      Spire decidedly depressed. . . . . *möllendorffi* Bartsch
Incised spiral lines absent.
  Color bands present.
    Greater diameter more than 14 mm. . . . . *peracutissimus* Wagner
    Greater diameter less than 13 mm.
      Interior suffused with red. . . . . *tagbilleranus* Bartsch
      Interior not suffused with red. . . . . *cumingi* Bartsch
  Color bands absent.
    Shell broadly conic. . . . . *lazarus* Sowerby
    Shell narrowly conic. . . . . *duponanus* Bartsch

It is interesting to note that in none of the species so far known do we find the junction of the columella and basal lip forming a decided angle. The subgenus can be divided into two sections on the presence or absence of fine incised spiral lines.

The section in which incised spiral lines are present embraces five species coming from the islands of Luzon, Marinduque, Siquijor, and Cebu, while the six belonging to the section that has no incised spiral lines come from the islands of Luzon, Negros, Bohol, and Leyte.

Of those having incised spiral lines, two are provided with collar bands. One of these, *Geophorus* (*Diplopinax*) *acutus* Pfeiffer, is much larger than the other. A cotype, Cat. No. 104393, collected by Cuming at Argao, eastern Cebu, has 5.5 whorls and measures: altitude, 8.3 mm.; greater diameter, 13.8 mm. The smaller banded form, *Geophorus* (*Diplopinax*) *albocarinatus* (Möllendorff) Wagner, comes from the island of Siquijor. A specimen, Cat. No. 195505, having 5.1 whorls measures: altitude, 6.6 mm.; greater diameter, 10 mm.

Of the three unbanded species one, *Geophorus* (*Diplopinax*) *bothropomus* Möllendorff, is quite large. Of this I have not seen specimens. Wagner figures the operculum and gives the following measurements: altitude, 9.5 mm.; greater diameter, 18 mm. It comes from Caramoan, Luzon. The other two species are decidedly smaller. One of these *Geophorus* (*Diplopinax*) *conoidalis* Möllendorff, has the spire decidedly elevated and the base but very slightly rounded. A specimen of this species, Cat. No. 258786, has 5.3 whorls and measures: altitude, 7.4 mm.; greater diameter, 10.8 mm. The last species, *Geophorus* (*Diplopinax*) *möllendorff* in. sp., has the spire rather depressed and the base strongly rounded. The type, Cat. No. 195503, comes from the island of Siquijor. It has 5.1 whorls and measures: altitude, 4.9 mm.; greater diameter, 9.8 mm.

The section lacking incised spiral lines can be divided into a banded and plain group. The banded group embraces three forms, of which *Geophorus* (*Diplopinax*) *peracutissimus* Wagner is quite large. This species comes from the island of Negros. A specimen, Cat. No. 302777, having 5.1 whorls measures: altitude, 8 mm.; greater diameter, 14.6 mm. This has a faint brown band at the summit and another above and below the periphery, a little within the edge. The other two forms are of medium size. One, *Geophorus* (*Diplopinax*) *cumingi* n. sp., collected by Cuming on Negros, has the color bands as in *Geophorus* (*Diplopinax*) *peracutissimus* Wagner, but the shell much more elevated. The type, Cat. No. 302739, has 5.2 whorls and measures: altitude, 7.5 mm.; greater diameter, 11.2 mm. The third banded species, *Geophorus* (*Diplopinax*) *tagbilleranus* n. sp., has the last whorls suffused with red and the interior of the same color. The type of this, Cat. No. 258760, comes from Tagbileran, Bohol. It has 5.2 whorls and measures: altitude, 7 mm.; greater diameter, 11.9 mm.

Two species and a subspecies are known of the unbanded forms. Of these one, *Geophorus* (*Diplopinax*) *lazarus* Sowerby, is a broadly conic, medium-sized shell that comes from the region of Bongabong, Nueva Ecija, Luzon. A cotype of this, collected by Cuming, Cat. No. 302740, has 4.9 whorls and measures: altitude, 5.9 mm.; greater diameter, 11.6 mm. The subspecies, *Geophorus* (*Diplopinax*) *lazarus transitans* Wagner, which comes from Libmanan, Ambos Camarines, Luzon, is said to have measured: altitude, 7 mm.; greater diameter, 12 mm. The remaining species, *Geophorus* (*Diplopinax*) *duponanus* n. sp., has the shell narrowly conic. The type, Cat. No. 258787, comes from the west shore of Port Dupon, Leyte. It has 5 whorls and measures: altitude, 6.5 mm.; greater diameter, 9.4 mm.

In the preceding synopsis of the Philippine members of the genus *Geophorus*, all but the following three known forms, of which no specimens were at hand, have been heated. I suspect that all three of these belong to *Geophorus* in the restricted sense, but shall refrain from assigning them to a definite position until representative material will make it possible to do so positively. These forms are: *Geophorus trochiformis gibbosulus* (Möllendorff) Wagner cited from Tayabas, Luzon; *Geophorus agglutinans solidulus* (Möllendorff) Wagner, from the island of Lubang; and *Geophorus acutus intermedius* (Möllendorff) Wagner from the island of Cebu.

ABSTRACTS

Authors of scientific papers are requested to see that abstracts, preferably prepared and signed by themselves, are forwarded promptly to the editors. The abstracts should conform in length and general style to those appearing in this issue.

CRYSTALLOGRAPHY.—*The application of optical methods of identification to alkaloids and other organic compounds.* EDGAR T. WHERRY. U. S. Dept. Agr. Bull. 679. Pp. 9. 1918.

The value of optical methods for identifying crystalline substances is pointed out, and methods for the study of substances such as alkaloids are outlined. The observations recommended are: I. In ordinary light: Color, habit, angles, cleavage, and refractive indices; detailed directions with respect to the last are given, including the preparation of special immersion liquids of solutions of potassium-mercuric iodide, which are required for certain alkaloids. II. In parallel polarized light: extinction, double refraction, and sign of elongation. III. In convergent polarized light: class, sign, and dispersion. The details of manipulation are illustrated by describing the procedure in the case of cinchonine. E. T. W.

CRYSTALLOGRAPHY.—*The identification of the cinchona alkaloids by optical-crystallographic measurements.* EDGAR T. WHERRY and ELIAS YANOVSKY. Journ. Amer. Chem. Soc. **40**: 1063–1074. 1918.

The methods described in the paper previously abstracted were applied to carefully purified cinchonine, cinchonidine, quinine, and quinidine, crystallized from alcohol and from benzene. The optical properties of these are presented in a standard formal description and then tabulated in columns to show the differences. Determinative tables based on the properties measured are given. The results of crystallization of mixtures are also described, and a method for the examination of a medicinal preparation containing these alkaloids outlined. E. T. W.

CRYSTALLOGRAPHY.—*Modern extensions of Hauy's laws of crystallography.* EDGAR T. WHERRY. Amer. Mineral. 3: 134–136. 1918.

It is pointed out that many of the modern developments in crystallography represent logical extensions of the laws formulated by Hauy over 125 years ago. E. T. W.

MAMMALOGY.—*The rice rats of North America (Genus Oryzomys).* EDWARD A. GOLDMAN. N. Amer. Fauna **43**: 1–100, pls. 1–6, figs. 1–11. September 23, 1918.

The genus Oryzomys, of wide distribution in North and South America, has, for the systematist, long been one of the most difficult groups of small mammals; and there has been a considerable difference of opinion as to the status and distribution of the comparatively few forms found in the United States, while the intricate maze of species and subspecies in the Tropics has proved a stumbling block for almost every worker. In every extensive collection many specimens were wrongly determined, or simply stored without an attempt at specific identification.

In the present revision Major Goldman has recognized 51 forms from Panama northward, 44 of which he places in the typical subgenus Oryzomys, 5 in the subgenus Oligoryzomys, and 2 in the subgenus Melanomys. Two Mexican subspecies are described as new: *Oryzomys melanotis colimensis* from Armeria, Colima; and *Oryzomys fulvescens mayensis* from Apazote, Campeche. The author predicts that when many regions now unexplored are carefully worked by collectors, the forms assignable to Oryzomys will probably far outnumber those of any other genus of American rodents. More than 150 species and subspecies have already been described in the genus, many of these from South America and therefore extralimitary to the present paper. Some forms have in late years been separated from Oryzomys by the erection of closely allied genera, and a careful revision of the South American genera, subgenera, species, and geographical races of Oryzomys and its allies, somewhat comparable to Goldman's work, would be a boon to mammalogists. The relationships between the genera and subgenera of Oryzomys-like rodents are especially complex and there will doubtless always be a considerable difference of opinion regarding the relative values of the named groups, the various sections blending one into another in an intricate manner. The author calls attention

to the intimate relationships between Oryzomys and Nectomys, and other American cricetines, and incidentally expresses the opinion that Nesoryzomys, based by Heller on rice rats inhabiting the Galapagos Islands, is a synonym of Oryzomys.

Keys to the forms; lists of specimens examined, with footnote reference to the museums where the material from various localities may be found; average and extreme dimensions of specimens; detailed distribution of each form; and, in the plates, nearly 100 well-selected figures of skulls and teeth; all add to the values of the revision, which is based on the examination of 1613 specimens assembled from the various larger American museums. N. HOLLISTER.

PHYTOPATHOLOGY.—*Seed treatment control and overwintering of cucumber angular leaf spot.* W. W. GILBERT and M. W. GARDNER. Phytopathology **8**: 229–233. May, 1918.

The authors give the results secured from small and large scale tests of disinfecting cucumber seed to control angular leaf spot. The treatments tried consisted in soaking the seed for 5 to 10 minutes in solutions of mercuric chlorid (1 to 1000), copper sulfate (0.5 and 1 per cent), and formalin (2 and 4 per cent) and then washing in running water. Hot water treatment (52°C. for 10 minutes) was also tried. Half-acre field tests carried on at Madison, Wisconsin, showed conclusively that all the treatments tried almost entirely eliminated the disease from the seed. The mercuric chlorid treatment (1 to 1000 for 5 minutes) is considered the safest, most practical, and most effective method tested. Both formalin and copper sulfate caused some injury to germination. The effectiveness of the treatment with mercuric chlorid was further tested on about 150 cucumber fields in Wisconsin and Indiana, in one half of which the seed used was treated and in the remainder untreated. The original seed was from the same source. Observations made near the end of the season showed a very considerable reduction in the amount of disease on fields not previously in cucumbers planted with treated seed. The data secured on overwintering indicate that the disease does live over in the soil to a considerable extent, making it inadvisable to plant cucumbers on the same land two years in succession.

Seed disinfection and crop rotation are advised as methods of controlling angular leaf spot. W. W. G.

PLANT PHYSIOLOGY.—*Boron: its effect on crops and its distribution in plants and soil in different parts of the United States.* F. C. Cook and J. B. Wilson. Journ. Agr. Res. **13**: 451–470. May 27, 1918.

This is the final paper of a series of three dealing with this subject. The influence of borax (sodium borate) and of calcined colemanite (calcium borate) was studied on various cultivated plants. The experiments in some cases extended over three years and the maximum amount of borax used was in excess of that which truck growers, in applying manure treated with borax to kill larvae of the house fly, might possibly add to their cultivated fields. Soils showed a decided difference in rendering the added borax nontoxic to plants. There was a complete disappearance of detectable amounts of soluble borax and of colemanite, although small amounts of total borax were found. It is evident that insoluble borax compounds are formed in the soil. The calcium of the colemanite did not prevent the absorption of borax by the plants.

The amounts of borax absorbed seemed to vary with the variety of plant, the solubility of the borax compound used, the amount added to the soil, the time elapsing after the compound was added to the soil before planting, the amount of rainfall, etc., and finally with the character of the soil to which the borax compound was added.

The distribution of the borax in different parts of the various plants was investigated and results showing the influence on the yield of some of the crops are included. F. C. C.

AGRONOMY.—*Effect of temperature and other meteorological factors on the growth of sorghums.* H. N. Vinall and H. R. Reed. Journ. Agr. Res. **13**: 133–148, pls. 11, 12. April, 1918.

The purpose of this study was to determine the reactions of the sorghum plant to climatic conditions. Several varieties were grown under field conditions at Chillicothe, Texas; Bard and Chula Vista, California; and Puyallup, Washington. The average of the monthly means of temperatures for the growing seasons at the above points was 75.6°, 81.8°, 62.4°, and 60.4° F., respectively. The percentage of actual to possible sunshine was 75, 93, 68, and 46. The total degrees of positive temperature received by the sorghums at Chillicothe was 3028°, at Bard 4236°, at Chula Vista 1895°, and at Puyallup 1615° F.

None of the sorghums matured at Puyallup, but all matured at Chula Vista with only 280° difference in the total of positive temperatures.

This would seem to indicate that the amount of sunshine is an important factor in bringing sorghums to maturity.

The conformance of the sorghums at Chillicothe, Bard, and Chula Vista to Linsser's Law of Growth was remarkable. The "physiological constant" according to this law, for the period from planting to maturity was for Chillicothe 0.539, Bard 0.530, and Chula Vista 0.526.

Vegetative characters which are ordinarily considered stable, such as the number of leaves per plant, varied with the climatic conditions. Blackhull kafir had 3 and Sumac sorgo 6 more leaves at Bard than at Chula Vista. The varieties also showed decided differences in height and diameter of the stem and in the size of the leaf at these two places.

Studies on the effects of different dates of planting at Bard, indicate that "more favorable conditions are obtained if the date of planting is regulated so that the early stages of the plant's development coincide with a period of high temperatures and the later stages, when the plant is nearing maturity, come when moderate temperatures prevail."

H. N. V.

TECHNOLOGY.—*The milling and baking tests of einkorn, emmer, spelt, and polish wheat.* J. A. LeClerc, L. H. Bailey, and H. L. Wessling. Journ. Amer. Soc. Agron. **10**: no. 5. 1918.

A description of these various rare wheats is given, and likewise the composition of the flours and characteristics of the bread made from the flours of these rare wheats. It is shown that the rare wheats, emmer and spelt (both free of hulls) and polish wheat can be milled into a satisfactory flour and the flour used in baking a good loaf of bread. The results obtained from einkorn (free of hulls) are not so encouraging.

J. A. L.

TECHNOLOGY.—*The chemical analysis of wheat-flour substitutes and of the breads made therefrom.* J. A. LeClerc and H. L. Wessling. U. S. Dept. Agr. Bull. 701. 1918.

The work embodied in this bulletin was started in 1912. Included are found the chemical analysis of some 30 substitutes which may be used in combination with wheat flour in the making of bread. There is also found the analysis of the various breads made from a combination of three parts of wheat flour and one part of substitute. Photographs of the different breads as well as certain descriptive physical characteristics of these breads are given.

J. A. L.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

WASHINGTON ACADEMY OF SCIENCES

The 124th meeting of the ACADEMY was held in the Assembly Room of the Cosmos Club the evening of Thursday, April 18, 1918, with President BRIGGS presiding, the occasion being the fifth lecture of the series on Science in Relation to the War, by Lieut. Col. X. REILLE, Chief of Artillery in the French Advisory Mission. The address, entitled *The problem of anti-aircraft firing*, has since been published in the JOURNAL (8: 465–480. August 19, 1918).

The 125th meeting of the ACADEMY was held in the Assembly Room of the George Washington University Medical School the evening of Thursday, May 9, 1918, with Vice-president ROSE presiding. The occasion was the sixth lecture of the series on Science in Relation to the War, by Dr. RAYMOND PEARL, of the United States Food Administration, entitled *Biology and war*. This lecture has been published in the JOURNAL (8: 341–360. June 4, 1918).

The 126th meeting of the ACADEMY was held jointly with the Chemical Society in the Assembly Room of the Interior Department the evening of Wednesday, May 15, 1918, with Vice-president POWER presiding. The address, by Dr. ARTHUR A. NOYES, Professor of Theoretical Chemistry at the Massachusetts Institute of Technology, and Chairman of the Nitrate Committee, entitled *The nitrogen problem in relation to the war*, has been published in the JOURNAL (8: 381–394. June 19, 1918). It is the seventh of the series on Science in Relation to the War.

WILLIAM R. MAXON, *Recording Secretary*.

THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

The 316th regular meeting of the Society was held at the hall in the Perpetual Building Association's building, 1101 E Street, N.W., November 6, 1918. There were present 24 members and one visitor.

The following new members were elected: Messrs. O. K. COURTNEY and P. W. MASON, of the Bureau of Entomology and Dr. NORMAN PERRINE, of the Federal Horticultural Board.

The PRESIDENT announced the death of two of our fellow members, viz., Mr. FREDERICK KNAB and Mr. A. B. DUCKETT, and the meeting was, for a short time, turned into a memorial meeting in honor of the

deceased. Resolutions on the death of Mr. Duckett were read and a copy of same ordered sent to the bereaved family. Short remarks laudatory of Mr. Duckett were made by Messrs. GAHAN, POPENOE, CUSHMAN, SCHWARZ, and SNYDER.

The PRESIDENT read a short statement by Dr. L. O. HOWARD on the life and work of Mr. Knab, after which short but eloquent tributes were paid to his memory by Messrs. ROHWER, WALTON, ELY, and PIERCE. The PRESIDENT announced that he would name a committee to prepare a short biographical sketch and a bibliography of Mr. Knab's work.

The regular program was as follows:

MANN, Dr. W. M.: *Notes on collecting in Fiji.* Mr. Mann told of a collecting trip through the Fiji islands in 1915–1916. The trip was made as a Sheldon Traveling Fellow of Harvard University, the object being to study the insect and, as far as possible, other faunae from the standpoint of zoogeography.

The Lau Archipelago, first visited, was little productive. The visit was during the dry season but it is probable that at other seasons the fauna is also poor. These islands are almost entirely coralline limestone and isolated. In the forests, generally at high altitudes on the larger islands of Fiji proper, life was abundant and the proportion of endemic forms large. Considerable material was collected and a report on the ants is in preparation.

Several points of local distribution were discussed. One moth, the larva of which bores into coconut leaves on the island of Viti Levu, the largest island in the group, has weakened the trees so that practically no nuts are produced. It is remarkable that this species has never spread to the other islands, especially those near by, considering the strong winds and hurricanes that are so prevalent in Fiji.

One of the serious insect pests of the coconut is a large phasmid. This occurs so abundantly that on one plantation where Hindu labor was employed, phasmid collecting was given to some of the laborers as a task, and seven pounds weight of the insects required as a day's work. They collected this amount apparently with little trouble.

SANFORD, H. L.: *The chrysanthemum gall fly.* Mr. Sanford's paper dealt with the life-history, distribution, and control of this imported pest of chrysanthemums, and was illustrated by several interesting specimens of its work and also by some photographs.

ROHWER, S. A.: *Notes on and descriptions of sawflies.* (Read by title.)

GREEN, C. T.: *A note on the habit of* Pegomyia affinis *Stein.* (Read by title.)

FISHER, W. S.: Chrysobothris transquebarica *versus* impressa. (Read by title.)

COCKERELL, T. D. A.: *Descriptions of new bees.* (Read by title.)

MOSIER, C. A. and SNYDER, T. E.: *Further notes on Tabanidae from Florida Everglades.* (Read by title.)

A. B. GAHAN, *Secretary.*

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